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RICHARD P. CHAYKOWSKI AND GEORGE A. SLOTSVE

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# Employee Perceptions of Organizational Practices and the Impacts of Plant Modernization: A Canadian Case Study

By *

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## 1 Introduction

This paper reports results from a case study research project that is investigating the operation of internal labour markets as well as the likely impact of a firm's recapitalization program on employee skill levels, workplace organization, employee-management relationships and the internal structure of the firm.[1] The company analyzed has been pursuing a strategy of introducing new technology (particularly new equipment) and related work methods throughout its operations. The goals have generally been to increase productivity, reduce unit production costs, and improve various aspects of performance (e.g., safety). In 1986 the firm announced a major capital investment program at the particular refinery studied, involving a plan to substantially modernize the refinery at an approximate cost of $17 million.

The particular refinery analyzed constitutes a unique case of an internal labour market that is characterized by occupational ports of entry, a well-defined hierarchial job and wage strucutre, the existence of unique tasks, a reliance upon specific skills, and a promotion-from-within policy.[2] Two particularly important characteristics relevent to this firm are organizational skill specificities and the task idiosyncrasies of jobs, the latter feature arising at this firm, for example, from the presence of firm-specific communication and information channels, unique equipment, and specific processes (in general, see Doeringer and Piore (1971) and Williamson, Wachter and Harris (1975)).

We focus specifically on the results for several surveys of the current work practices, employment experience, and supervisory practices of both management and hourly-rated employees of the refinery. First, the information from the surveys provides a valuable data source which allows us to more fully characterize the essential features of the type of internal labour market typically found in large unionized industrial firms. Specifically, we are able to assess how work is organized, the nature of the relationship of employees to their supervisors, the structure of the job and wage hierarchy, and the employee firm-specific training requirements.

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[1] Chaykowski and Slotsve (1988b) provide a broad analysis of the related impacts of the firm's recapitalization program on the wage structure, job content, job structure, and employee training. The discussion and conclusions of this paper also rely upon both formal and informal dicussions with management and union officials. The last on-site visit to observe the impacts of various technological innovations took place in January of 1989.

[2] See Livernash (1957), Doeringer and Piore (1971), and Williamson, Wachter and Harris (1975) for the identification of such features, as those which characterize the organization analyzed, as also defining characteristics of internal labour markets.

Second, we wish to examine the extent to which various features of the internal labour market of the organization are likely to be transformed as a consequence of the introduction of new production technologies.[3] That is, are firm characteristics such as skill specificities or uniqueness of equipment likely to become more or less pervasive or accentuated? Furthermore, will the transformation of institutional characteristics have further implications for training programs and work organization? The surveys focus specifically on the expected impact of plant modernization on the firm's organization, thereby permitting us to assess the effects of the introduction of technological innovations on employee training requirements, skill levels, and work group inter-relationships.

Ongoing changes in the firm's internal labour market, which have been induced by intense international competitive pressures and the concomitant introduction of both embodied and disembodied technologies into the refinery, are characteristic of the restructuring of the Canadian industrial base. The following analysis will therefore also contribute to an understanding of the various consequences of this transformation of production processes for the organization of the workplace, workforce skilling, and the structure of the job hierarchy--with further consequences for firm productivity. Finally, the results of this analysis will provide insights into appropriate firm-level labour policies both in the short run and in the medium term and management and union adjustments to changes in various institutional features.

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[3] Chaykowski and Slotsve (1988a) develop a formal theoretical model of a unionized firm's promotion system that also accounts for internal firm structure and then analyze the likely impact of changes in the internal job hierarchy (induced, for example, by changes in production technologies) on job-change opportunities and wage growth.

In section 2 we describe the structure and operation of the internal labour market prior to the recapitalization program and the structural changes associated with the impacts of the introduction of new production technologies. In section 3 we outline the construction of the survey instruments and the application of the surveys to the various groups of refinery employees. Section 4 presents the survey results which allow us to characterize the functioning of the organization's internal labour market and the nature of the worker-management relationship. Section 4 also analyses the impact of the technological change program on work practices and the worker-management relationship. We conclude with implications of the plant modernization program for employee training, the preferred arrangement of work practices, and union and firm human resource initiatives in the post technological change environment.

## 2 The Internal Structure of the Organization

The installation studied is a single metals refinery of a partially vertically integrated industrial firm. The refinery is located in an Ontario urban centre. The entire firm has international operations and is also a world leader in its major product lines. The company operates numerous facilities, each of which is exclusively in the private sector. The hourly-rated employees studied in the analysis are blue-collar workers covered by a collective bargaining agreement which was negotiated by a single local of a major international-based industrial union. In contrast, the line supervisors surveyed are all non-unionized management employees. The internal structure of this plant is highly representative of the type of internal labour market found in refineries operating in Canada and the United States throughout the 1960 to 1990 era.

Overall refinery workforce levels were generally stable during in the pre-1980 time period. However, in the post-1980 recessionary period workforce levels at the refinery were drastically reduced. During the 1981 to 1987 period, workforce reductions at the refinery were a consequence of both the policy to downsize the workforce as well as the introduction of new technology, although rationalization of the firm's workforce per se was the most important single factor.[4] During the 1981 to 1985 period, total refinery personnel were reduced by approximately 28% from 833 to 579 personnel (this downsizing was comprised of a 28% reduction for unit and 21% reduction for staff). These workforce reductions were a part of a company-wide policy of employment downsizing throughout its operations world-wide. The largest proportion of the total reduction occurred between 1981 and 1982 (see Table 14). During the 1984 to 1987 time period workforce levels have been generally stable with only small total workforce reductions from 614 personnel in 1984 to 579 personnel in 1987. The 1981 to 1987 period was therefore characterized by an initial major workforce reduction followed by a period of relative employment stabilization before the introduction of significant new production technologies beginning in 1987.

The wage and job structures have been long established at the refinery. The managerial structure may usefully be characterized as consisting of those staff strictly involved in refinery production matters (including the Operations and Maintenance divisions) and staff in administrative, personnel, and various support functions.[5] Production-related staff, in order of responsibility, include the manager, superintendents, general foremen and foremen. The foremen are the front-line supervisors who are responsible for the direct supervision of the workforce.

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[4] There are no data which exist that allow us to disaggregate these two causal factors.

[5] We find this distinction useful but in many respects very arbitrary. In contrast, we prefer the view that both the staff involved directly in production as well as staff responsible for various personnel and human resource functions contribute to plant production although the latter group contributes indirectly. While it is extremely difficult to measure the contribution of personnel and human resource personnel to production directly, it is clear that a positive labour relations climate (for example, low grievance rates and progressive employee training) contributes to employee productivity and therefore to the profitability of the firm.

Two pioneering analyses of the effects of plant-level industrial relations practices on the economic performance of the firm are Katz, Kochan and Keefe (1987) and Cutcher-Gershenfeld (1988).

The hierarchical structure of the refinery consists of two major divisions: Operations (consisting of Operations A, Operations B) and Maintenance. The Operations A group in turn consists of three areas, denoted A1, A2 and A3; the Operation B group consists of three areas denoted B1, B2, and B3 while maintenance consists of four areas: M1, M2, M3, and M4. Generally, people most tend to change jobs within either Operations or Maintenance. Each of the Operations and Maintenance divisions form an individual job ladder, which together comprise the internal labour market at this refinery. In general, the firm relies almost exclusively on in-plant on-the-job training for the skilling of its workforce.

The internal wage and job structure within which the hourly-rated employees work is characterized by considerable wage and job-type rigidity. For example, there are approximately 23 wage rates or steps but approximately 82 job-types in active use. Therefore, a single wage rate corresponds to numerous job-types. Furthermore, there is a wage differential of only approximately $4.00 between the highest and lowest wage rate available. The compressed wage hierarchy therefore allows for very little employee differentiation on the basis of wage rates.

Occupational ports of entry into the refinery vary depending upon whether or not one considers the Operations or the Maintenance division. In both of the Operations groups the major port of entry is the laborer level (wage step 1 or wage step 2 of 23 steps). All workers entering the refinery enter at this base level regardless of whether they are new company employees or they are company employees transferring to the refinery from another location. In the latter case the seniority of the transferred employee is not a criterion in determining the entry level occupation because each job-type in the refinery is considered unique to the plant.[6] Instead, in order to advance from the labourer position employees must train on jobs at the next available level to fulfill the specified training requirements for each particular job-type before they are eligible to obtain that position. This training requirement also holds for new company employees. The need for outside training is therefore minimal because in the Operations division the jobs are too unique to the particular refinery.

Each job-type in the Operations division has a specified amount of formal on-the-job training associated with it.[7] Each job-type throughout the job hierarchy relies almost exclusively on in-plant on-the-job training. For each job-type, this training generally consists of two generic types. First, "core training" which consists of training "packages" which cover one specific aspect of the job responsibilities. Each person is evaluated on the completion of a particular package. When an individual is deemed qualified in each area associated with a job-type then that individual is eligible to apply for that job. The second class of training, termed "operator training", may involve substantial on-the-job learning and evaluation. The foreman is required to evaluate the employee upon completion of all requirements for operator training. Overall, as one moves up the hierarchy the difficulty and complexity of the training packages associated with operator training increases. In addition, the levels of responsibility would also generally increase and the worker is typically required to be knowledgeable in all previous jobs they have mastered in a cumulative fashion.

Training in the Maintenance division occurs in a manner analogous to that in the Operations division but with several important differences. First, for maintenance workers the port of entry may be at virtually any level in the Maintenance hierarchy, provided that the job-type is not deemed unique to the refinery.[8] However, it is quite likely that new employees from outside the Maintenance Division would undergo extensive on-the-job training and would begin at or near the bottom of the Maintenance hierarchy.

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[6] An employee's seniority is defined as their continuous tenure with the company and is transferred to all plants in the company's division.

[7] The emphasis upon specific training in this firm reflects the importance, in general, of task idiosyncrasies and specific skills in the operation of internal labour markets. Refer to Livernash (1957), Doeringer and Piore (1971), and Williamson, Wachter and Harris (1975).

Workers in the Maintenance division change job-types and move up the hierarchy by first fulfilling the training requirements of the next level job. The Maintenance worker must complete specific training modules associated with each job-type. However, instead of operator training, the second component of the training requirements in the Maintenance division is on-the-job "apprenticeship". Again, as in Operations, the effect of on-the-job training is cumulative as one moves up the job hierarchy. As in the Operations division, the need for outside training is minimal because in the Maintenance division the tradesmen are likely to have more expertise within the refinery than could be obtained outside the plant.

In view of this structure of the internal job and wage hierarchy, the re-capitalization program at the refinery involves a significant reconfiguring of the workforce and the job structure. Specifically, the introduction of new technologies will have the effects of dramatic reductions in hourly (hence staff) employment levels, reduction in the number and configuration of job-types, and refinery departmental restructuring. In addition, new technologies will require increased skill levels and new types of job training. It is also anticipated that the introduction of the new technologies will require increased flexibility in task assignment and the introduction of work groups or teams, where the teams will be required to perform both operations and maintenance functions. To the extent that equipment becomes more idiosyncratic at the refinery, and to the extent that operators of unique equipment "know their own machine best", then those operators of new equipment are likely the best prepared to effect repairs and hence maintain production. The advent of less generic equipment is likely to also lead to maintenance training difficulties as machine components become increasingly unique to specific equipment.

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[8] For example, an instrumentation man would be able to transfer from another plant in the company to this refinery without beginning at the bottom of the maintenance hierarchy. The reason for this is that the position of instrumentation men is roughly comparable across plants. This situation of skill transferability has in part arisen because the Maintenance Division is administratively integrated across plants.

The advent of new production processes also suggests that as the number of job-types is reduced (because many existing job-types will correspond to tasks that no longer exist) and as the new equipment requires fewer operators and job-types, (because job-tasks will also be consolidated), then the knowledge and training required in both newly defined and newly created job-types will broaden. Therefore the adoption of new technologies will generally require the creation of new job-types at the refinery and the eventual elimination of job-types associated with tasks and skills that are no longer required. Job redefinition will also involve the broadening of existing classifications. In either case, long-tenured workers may require extensive retraining that in practice neither the firm nor the employee view as a viable human capital investment, since the period remaining in which to capture returns to new training is limited. This poses one of the most fundamental and generalizable labour issues facing employees and management and that arises as a consequence of the introduction of new technologies.

## 3 The Survey Instruments

### 3.1 Survey Design

Two distinct surveys were applied to the hourly-rated employees of the refinery. A "Survey of Work Conditions" included questions regarding conditions and practices relating to each of the following areas: employee current job-type; permanent job-changes from one job-type to another; temporary job-changes; and background questions regarding both the socio-demographic background and the work history of the respondent. A "Survey of Work Experience" included questions regarding each of the following areas: accident experience; employee relationship with the foreman; the introduction of technological change; and also background questions regarding both the socio-demographic background and the work history of the respondent.

Generally, three types of questions were asked of the hourly-rated employees. The first type of question required a yes/no response to a statement. The second type of question allowed the respondent to indicate one particular category among several possible choices. The third type of question asked the respondent to rank the level of (non)importance or the extent of (dis)agreement with a given factor or statement, respectively, on a Likert-type scale of 1 to 5 [see Likert (1932)]. The basis of a given ranking is the respondent's perceived degree of importance of a given factor or level of agreement with a given statement.

The construction of the five-point scales used in the two surveys follows Likert (1932) by using two extremes or "poles" with several intermediary positions between the two extremes. The middle position on the scale typically signifies an undecided or indifferent response. Use of a middle position follows Presser and Schuman (1980, pp. 76-77), who point out that use of a middle position involves the assumption that respondents choosing the middle position actually desire this response, thereby suggesting that forcing respondents to the poles by omitting the middle position will result in error.

The survey of refinery production and maintenance staff, the "1987 Survey of Refinery Practices", was applied to all first-line foremen in the refinery.[9] The survey was intended to measure the extent of the usage of various work practices in the areas of scheduling and hours of work, vacancies and temporary job openings, the organization of work at the level of the shop floor, work practices related to task completion, subcontracting, orientation and training, repairs and inspections, discipline, employee participation and communication, and the introduction of new technologies into the workplace. All questions were related to actual work practices for the (unionized) hourly production or maintenance employees supervised by the foreman in 1987, and did not include work practices of office or professional employees.

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[9] The 1987 survey of Refinery Practices was based upon the survey instrument used in Katz, Kochan and Keefe (1987). The authors would like to thank Harry Katz for making available the survey instrument used in their research.

The staff survey questions were generally of four types. First, some questions asked the foreman to indicate a yes/no response to a statement. Second, some questions asked the foreman to indicate, for a given statement about a work practice, what percentage of the total production/maintenance workers that s/he supervised actually participated in the stated practice in 1987. Third, some questions asked the respondent to provide a specific number. Fourth, many of the questions were open-ended and required the respondent to provide written information or extended explanations. This last type of question was most frequently used in the final section of the survey which focussed on technological change.

### 3.2 Application of the Survey

The two surveys of hourly-rated employees were administered to the respondents during October of 1987. Small groups of randomly selected employees from various departments in the refinery were allowed time from the normal work day to complete the surveys in a separate training room on the plant site premises. The two separate hourly employee surveys were distributed at random. The "Survey of Work Conditions" was completed by 56 hourly-rated employees while the "Survey of Work Experience" was completed by 31 hourly-rated employees.

In contrast, the survey of staff members was distributed to the foremen by their supervisors (general foremen) in separate packages. All packages contained self-addressed, postage-paid envelopes, so that the foremen could complete the survey on their own time and return the completed survey anonymously by mail. The "1987 Survey of Refinery

Practices" was completed by 28 refinery foremen, for a response rate of approximately 60%.

The survey data of hourly-rated and staff employees at the refinery is unfortunately only available to us as a point-in-time cross-section obtained when selected new production transformation programs had been completed but prior to the conclusion of the major portion of the entire recapitalization program. This data limitation therefore precludes an analysis of the ultimate impact of technological changes on the organization over time. However, the analysis does permit us to examine the adjustments of the employees and management to the process of implementing the new production equipment as well as their reactions to selected programs.

## 4 Survey Results[10]

### 4.1 General Respondent Background

Approximately 99% of the hourly-rated respondents are male, 81% are married, and 100% are over the age of 29. Approximately 13% of the respondents have neither English nor French as their first language. Approximately 16% of the respondents have less than 5 years of seniority at this refinery. The educational background of the workforce is highly uniform with roughly 97% of all hourly respondents attaining no greater than a high school level of formal education and 40% actually completing high school (grade 12 or 13). However, one-third of the sample has a certificate or diploma from a community college or institute and at least two-thirds have received training courses provided by the firm. Further, approximately two-thirds of all respondents worked for another company for at least one year before working for this company. Somewhat surprisingly, over one-third of the hourly-rated employees surveyed were employed by other firms before joining the firm at this refinery.

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[10] In all tables, "NR" is defined as the number of nonresponses.

Finally, the results of the survey support the view that a high proportion of employee's families consist of dual earners; it is interesting to note that in the Survey of Work Conditions, approximately 65% of the spouses of the respondents have full-time or part-time jobs. Further, a small proportion of hourly employees currently hold either part-time or full-time jobs other than at this refinery.

The sample size corresponding to the 1987 Survey of Refinery Practices (N=28) (applied to the refinery first-line supervisors) corresponded to approximately 60% of the total of all first-line supervisors. Among the supervisors, approximately 50% of the respondents were in the Maintenance division and 50% in Operations. On average, foremen supervise 17 hourly-rated employees, with 75% of the foremen responsible for 20 workers or fewer.[11] Approximately 79% of the staff respondents (N=22) indicated that there had been at least some new technology introduced into their work area during the years 1986 or 1987, or currently.

## 4.2 Current Stencilled Job Types and Work Arrangements

Information concerning the current stencilled job status of hourly-rated employees was developed from the Survey of Work Conditions. Approximately one-half of the respondents are employed in the Maintenance division and one-half in the Operations division of the refinery. The majority of the respondents have held their current job-type for longer than 5 years, with over 40% of the employees holding their current stencilled job-type for more than 10 years, suggesting a considerable lack of mobility among alternative job-types. Of those sampled, the mean wage rate is $12.40 per hour. Not surprisingly, respondents indicate that each of wages, safety, and workplace environment conditions are ranked as extremely important areas in which to obtain improvements. One interesting result is that better safety is ranked even higher (and with lower variance in response) than wages as an important condition in which to obtain improvements.

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[11] Discussions with plant management suggest that the finding of 17 employees supervised per foreman is high. Specifically, a company-wide figure more likely approximates 10 to 12 employees.

The results presented in Table 1 are based on the hourly-rated respondents' assessment of the importance of various criteria as requirements to capably perform their current job-type. Among all employees, the two factors which were consistently rated the highest (high mean and small standard deviation) were on-the-job training and company-sponsored training.[12] An underlying structural difference in responses between those employees in the Maintenance division and those in the Operations division exists for each of general schooling, trade certificate or diploma, and apprenticeship training criteria. The lower mean (and higher variance of the) rankings obtained for employees in the Operations division for each of these types of education are consistent with the observation that most of the skill requirements for Operations jobs in the refinery are unique to the production processes found in the company and require no trades education.The results for the 1987 Survey of Refinery Practices show that, on average, supervisors indicated that 55% of the workers they supervise are required to rotate job-types in order to gain proficiency among job tasks and 55% of the workers they supervise are required to learn different jobs within their work area.[13] The results also suggest that two extremes in practices exist. For example, in the total sample 18% of the supervisors indicated that 0% of their employees were required to rotate jobs while 39% of the supervisors indicated that 100% of the workers they supervise are required to do so. Similar extremes in the prevalence of work practices exist with regard to the requirement to learn several jobs in a work area.[14] (Not surprisingly then, approximately 44% of the supervisors (N=12) indicated that 0% of the workers they supervise participate in the certification of skill mastery among fellow workers.)

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[12] Note, however, that for Maintenance employees Apprenticeship Training ranks higher (higher mean) than company training, but that for Operations employees Apprenticeship Training is not at all important (lowest mean among types of criteria). These results are expected.

[13] An issue pointed out to us here is how one should define job rotation in the Maintenance division. For example, is rotation to be considered movement by job-posting from one job-class to another, temporary transfers between job-classes for several shifts only, or informally and temporarily covering the job responsibilities of co-workers?

Finally, in the total sample 57% of the supervisors allow none of the work assignments to be made by employees as a group rather than by a supervisor. Also, 64% of the supervisors allow none of the employees that they supervise to set individual work loads. Finally 61% of the supervisors allow none of the employees that they supervise to plan (design and layout) jobs in their work area.[15] These results indicating that most foremen do not involve the employees that they supervise in decisions regarding work assignments, work loads, and the design and layout of jobs are consistent in both the Maintenance and Operations divisions. Taken together, these practices indicate that foremen typically (in a majority of cases and for the majority of workers supervised) do not follow participatory and interactive management techniques. Rather, the results support the view of "directive" management practices. Moreover, it is evident that whereas participatory and interactive management techniques may currently be most feasible for Maintenance workers due to the nature of job tasks in that division, directive styles may be more appropriate in Operations. However, as workers become increasingly skilled and demarcation lines between occupations become blurred, the optimal management style is likely to shift toward participatory and interactive management techniques.

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[14] These extremes are structurally different between the Maintenance and Operations divisions. Among Maintenance (Operations) supervisors, 46% (7%) required 100% of the workers they supervise to learn different jobs in a work area and 54% (27%) of the foremen require 100% of the employees they supervise to rotate jobs. In contrast, among Maintenance (Operations) supervisors 8% (43%) require none of the employees they supervise to learn different jobs while 0% (33%) require none of the employees they supervise to rotate jobs.

[15] However, as a counter-result, 18% of the supervisors (N=3 in Maintenance and N=2 in Operations) indicated that 50% or more of the work assignments within a given work area are regularly made by employees as a group.

Some interesting results emerge for the supervision and work practices of Maintenance employees. Almost all of the responding foremen indicated that at least some (on average approximately 64%) of the maintenance employees they supervise will first, regularly perform some incidental tasks of other skilled trades and second, do all that is necessary to complete the job without calling in other skilled trades. Also, maintenance supervisors indicated, on average, that 37% of the time lines of demarcation between Maintenance and Operations are a penalty to efficient operation due to plant practices, whereas 31% of the time lines of demarcation are a penalty to efficient operation due to the collective bargaining agreement.

In the total sample, the majority of hourly workers indicated that they would prefer to be trained at a variety of job-types and a large minority of respondents indicated that job-rotation would also be desirable.[16] The results suggest that although employees experience few formal job-changes, there exists a strong desire to expand the range of tasks and associated skill levels. One interesting result is that in the total sample over 90% of the employees work in teams at some times and approximately three-quarters of the respondents work with one or more other workers; over 80% of the respondents indicated that they most prefer to work with others.[17] These results for work arrangements, taken together, support the conclusion that workers have had the opportunity to work in groups and/or teams and that this is a preferred work arrangement (refer to Table 2).[18]

These results for hourly employee preferences concerning co-workers are usefully supplemented by the results presented in Table 3, which consist of the tabulations for the respondents (dis)agreement ranking with a series of statements regarding their working relationships either with co-workers or with their foreman. The survey results for the entire sample suggest that, on average, the hourly-rated employees agree with the view that their foremen provide them with adequate information (although Maintenance respondents have a higher mean and lower variance), and that supervisors are aware of both production and health and safety problems (here Operations respondents have a higher mean and lower variance). However, the second greatest mean response and lowest variance is obtained for the respondents level of agreement with the view of their co-workers as a team. These strong results, when taken together with the above results which suggest that workers prefer to work in teams and/or groups, unambiguously suggest that employees prefer this form of work arrangement.

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[16] In Operations, 94% of the hourly worker respondents indicated a desire for training on other jobs.

[17] These results are generally consistent for both Maintenance and Operations divisions.

[18] Note that the survey does not seek to clearly distinguish "group" from "team" work organization.

From the Survey of Refinery Practices, in the total sample supervisor responses indicated that two extremes exist in their ability to temporarily reassign workers in the event of machinery or process downtime: approximately 50% of the supervisors (62% of Maintenance and 38% of Operations supervisors) indicated that less than 30% of the hourly employees they supervise can be reassigned temporarily, while the remaining 50% (38% of Maintenance and 60% of Operations supervisors) indicated that 80% or more of the hourly employees can be reassigned. Further, approximately 85% of all supervisors indicated that at least 60% of daily work time was typically utilized by hourly employees. This result is consistent in both Maintenance and Operations divisions. We expect that, all else equal, as Operations and Maintenance functions become increasingly integrated with regard to individual worker responsibilities, both hours worked per shift (minutes worked per hour) and the ability to temporarily reassign employees should increase, resulting in greater utilization of a given unit of labour.[19]

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[19] Note that this conclusion follows from the assumption that job-type content (hence training) broadens either through formal job-redefinition or through informal plant-floor practices. This conclusion may not follow if technological change results in idiosyncratic production processes and employee training becomes more "specific" as opposed to training that is still "broadening".

One measure of workforce task specialization is indicated by the nature of work practices associated with repair and inspection functions, which are typically important in refineries marked by (semi- or fully-) continuous production technologies. While the results indicate considerable variation in practices, Maintenance (Operations) foremen indicated that on average 11 (1) employee(s) that they supervise are involved primarily with repair functions and on average 4 (3) employees are involved with inspection functions, whereas only 4 (1) employee(s) are involved (on average) with both functions. Furthermore, among Maintenance (Operations) employees, supervisors indicated an average of 0 (7) employees perform formal inspection of their own equipment;[20] however, 21% of the Operations foremen (N=3) indicated none of the employees they supervise do so.

### 4.3 Permanent Job-Changes

The hourly employee Survey of Work Conditions included a series of questions which attempted to elicit the respondents' characterization of current job conditions and which factors were important in an assessment of the desirability of a movement into a new job-type. Hourly employee rankings of current job-type conditions (Table 4) indicate that in the total sample each of wages, safety, and quality of the environment were, on average, ranked the highest, with the former two factors achieving the lowest variance in response rankings.[21] For the remaining work conditions, Maintenance and Operations respondent sub-samples exhibit differences in mean rankings and/or variance. The high level of importance attached to nonwage work conditions is further reinforced by the result that 70% of all respondents indicated that a job-change is not viewed as a promotion regardless of other job conditions. Interestingly, in the total sample both safety and job environment ranked above wages as important factors considered when employees choose among new jobs to bid for (see Table 5). However, respondents in Operations had a higher mean ranking than respondents in Maintenance for each of More Wages, More Overtime Opportunities, and Less Physical Work, whereas Operations respondents had a lower mean ranking for Better Safety and for Better Environment. Among Maintenance respondents, Better Safety and Better Environment achieved the highest mean rankings whereas among Operations respondents More Wages and Better Safety had the highest mean rankings.

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[20] Discussions with plant management suggests that use of the term "formal" may be ambiguous in this context.

[21] For "better environment", Maintenance respondents had a higher mean ranking (with lower variance) than respondents in Operations.

The final areas covered by the Survey of Work Conditions are job-change criteria and training. Several very strong results are obtained for employee perceptions of each of their own, the company's, and the union's rating of three criteria used to determine whether a candidate obtains a job-change, including training, seniority and ability. As expected on the basis of the strong explicit role given seniority in job-changes in the collective bargaining agreement, hourly employees rated seniority as the most important factor to the union (greatest mean and lowest variance). Conversely, the respondents indicated that they viewed training as the most important factor to the company as a job-change eligibility criterion.[22] However, the respondents clearly indicated that they would rate training and ability as the most important job-change criteria, with approximately 0% of the respondents ranking training and ability as unimportant (assigned rank of 1 or 2) (see Table 6). However, it is also evident that 50% of the respondents indicated that seniority should be viewed as a highly important criterion in determining who obtains a job. [Note that, for each of Seniority, Training, and Ability, the mean ranking was higher among respondents in Operations than in Maintenance (with one exception of Seniority in Panel B of Table 6) and the variance of rankings was lower among respondents in Operations than in Maintenance (with one exception of Seniority in Panel C of Table 6).]

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[22] Although ability was also (on average) ranked high, the high variance makes this result less robust.

The foreman 1987 Survey of Refinery Practices indicates that when several employees bid for a job and each is minimally qualified for the new job, 93% of the supervisors (N=25) indicated that 90% - 100% of the time the promotion goes to the longest seniority applicant (refer to Table 7). However, if an individual is "head and shoulders" in ability above the longest seniority applicant, then 11% of the supervisors (N=3) indicated those high-ability workers will receive the promotion 70% - 100% of the time and 37% of the supervisors (N=10) indicated those high-ability workers will receive the promotion 10% - 100% of the time. The variance in promotion practices (1% of time) appears to be higher among Maintenance than among Operations supervisors with regard to both Seniority and Ability.

Finally, it is worth noting that approximately one-third of all hourly respondents indicated that they were trained prior to obtaining a new permanent job (including training packages, operator training, and apprenticeship training).[23] In the area of employee training, 100% of the supervisors indicated that employee training certification involved an observed assessment of the employee in the workplace 100% of the time, the supervisors written assessment 75% of the time in Maintenance and 93% of the time in Operations, and an employee written test only 36% of the time in Maintenance and 100% of the time in Operations (refer to Table 8). While most foremen use all three practices, these results clearly indicate that significant amounts of variation in training certification procedures exist in the refinery.

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[23] This result apparently runs counter to accepted management experiences.

### 4.4 Worker-Management Relationship

The hourly employee Survey of Work Experience included a section which asked respondents to evaluate their relationship with their foremen by ranking their level of agreement or disagreement with several statements about the supervisor/employee relationship. These results are presented in Table 9. For the total sample, the most consistent results were obtained for the complementary areas of agreement on each of how to perform work and on job safety (highest means and lowest variances).[24] Four dimensions of joint feedback and group interaction are indicated by employee perceptions of supervisor behaviour in each of the following areas: consultation in the planning of job tasks; seeking employee ideas; expressing interest in employee ideas; and feedback on employee behaviour. The typically high variance of responses indicates widely varying perceptions of the foreman's level of committment to employee interaction and involvement. The results for these four areas taken together indicate that typically 50% of those surveyed felt that their foreman did not actively pursue employee involvement. These results suggest that supervisors tend to fulfill a directive form of front-line management and tend not to engage in cooperative and interactive management practices in the supervision of the workforce.

The notion of the team work concept may be defined to include the broad spectrum of group inter-relationships, ranging from formal units with a designated hourly-rated or staff leader, to informal work groups directed by staff supervisors. Two key aspects of these forms of work groups are the level of information exchange and the degree of group decision-making, which in the context of this refinery refers both to the level of communication and to the level of employee participation in decision-making.

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[24] Note that the highest mean responses were obtained for Maintenance in the Agree on How to Perform Work and Worker Treated Courteously areas whereas the highest mean responses were obtained for the Operations respondents in the Agree on Job Safety and Agree on How to Perform Work areas. Finally, Operations responses had a higher mean and lower variance than Maintenance responses in both the Agree on How to Perform Work and Worker is Consulted in Planning Job Tasks categories.

In the area of communication, the results from the 1987 Survey of Refinery Practices indicates that great extremes in supervisor practices exist (Table 10). First, approximately 61% of the foremen (N=17) indicated that 20% or fewer of the employees they supervise regularly meet in groups to discuss production or quality problems with a supervisor, whereas only 21% of the supervisors (N=6) indicated that such discussions are regularly held with 100% of the workers they supervise. Second, approximately 50% of the foremen (N=13) indicated that 20% or fewer of the employees they supervise regularly track or are given statistical information on their work group's quality or productivity performance, whereas only 31% of the foremen (N=8) indicated that such information is regularly provided to 100% of the workers they supervise. Third, approximately 50% of the foremen (N=14) indicated that attitudes are regularly assessed or discussed regularly in group meetings for 20% or fewer of the employees they supervise, whereas 46% of the supervisors (N=14) indicated that such attitude assessment is regularly provided for 100% of the workers they supervise. Finally, 86% of the supervisors (N=24) reported that only 20% or less of the workers they supervise regularly receive formal training in group problem-solving, decision-making, and communications from the company, whereas 7% of the supervisors (N=2; both foremen are from Maintenance) indicated that problem solving training is regularly provided for 100% of the workers they supervise.

Taken together, these results unambiguously indicate that supervisor-employee communications involving each of performance, employee attitudes, work quality, and production problems is minimal. The survey results indicate that the only exceptions to these results are for the areas of workplace safety and employee perceptions of the economic conditions facing the company.

## 4.5 Technological Change

### Introduction

An essential aspect of the study is an analysis of the impacts of the introduction of new technologies into the refinery on work organization and work practices, including the relationships among co-workers as well as between supervisors and hourly-rated employees. The direct structural results of the modernization program include the alteration of production methods and the reduction of the labour-capital ratio. Some of the relevant considerations accompanying this latter effect will be the elimination of some job-types and the tasks associated with them and second, the creation of new job-types as a combination of pre-existing job-types (in which case the pre-existing job-types no longer exist). The net structural results are, therefore, a dramatic reduction in the number of job-types, the broadening of task responsibilities (and training requirements) through the combination of job-types and a workforce reduction, and a commensurate expected upskilling of the remaining workforce.

In this section we discuss employee perceptions of the current and expected impact of the introduction of new production technologies on organizational practices at the refinery. Note that the survey results of the impacts of technological change include the impact of selected new technologies that had already been introduced into the refinery at the time of the survey but naturally excludes employee perceptions of the impact of the remainder of the recapitalization program, which commenced after the application of the surveys.

### Perceptions of the Impact of Technological Changes

A major concern of employees, the union, and the management, is the impact of the recapitalization program on organizational practices at the firm. Two specific issues concern the organization of work practices among employees and between staff and hourly-rated employees. Preliminary observations suggest that increased reliance on group and/or team forms of organization among employees, and a team approach to foreman--hourly-rated employee relations, is well suited to the new production environment. The expected blending of operations and maintenance tasks, upskilling of the labour force, increased reliance on highly skilled employees in the production process, and increased propensity for independent decision making, together suggest a shift toward group and team forms of work organization (away from the current practices of staff direction of labour to perform tasks).

In general, embodied technologies are being introduced into the refinery. (Here embodied technology refers, for example, to new machinery (capital) which is the result of design enhancement or superior materials, whereas disembodied technology refers to direct technological advancement, such as new computer software). In both the hourly employee and staff surveys, the following broad definition of a new technology was used:

> ...a new technology is new machinery or equipment that significantly changes the methods of production or operations, or changes the type of product, or changes the organization of work or jobs.

The respondents were asked to consider the introduction of such new technologies over the past two years, since as of the end of the year 1987 only selective refinery production processes had undergone any technological transformation. As expected, differences in mean rankings exist between the Maintenance and Operations Divisions.

Approximately 47% of the hourly-employees surveyed indicated that their regular job had been either eliminated or redefined by technological change in some way over the past two years (altered with regard to training or work methods). In Operations (Maintenance) approximately 79% (53%) of the respondents indicated that they had been significantly affected by technological change. Of those employees affected by technological change, 27% (44%) in Operations (Maintenance) were retrained, 64% (44%) in Operations (Maintenance) use different tools as a result of technological change, 64%

(44%) use different machinery as a result of technological change and 71% (71%) were trained on the new machinery. Finally, evaluated on the basis of mean response and variance, the total sample results for the employee rankings of the impact of technological change on various working conditions (see Table 11) suggest that workplace safety and the level of physical work have both on average improved the most.[25]

Second, hourly employee ratings of the effects of technological changes on various work characteristics were examined. Following Rousseau (1977), we characterize job-type characteristics according to the variety of skills used at a given job-type, the opportunity for the employee to produce a whole piece of work, the significance of the job with regard to its effect on other employees, the level of decision-making autonomy, and the degree of performance feedback.[26] Potential changes in these five job dimensions, induced by technological changes, was assessed by asking the hourly employees to rate their level of agreement with individual statements related to one of the five broad areas that characterize jobs. Interestingly, the strongest individual result is obtained for hourly employee perceptions of the necessity of technological changes to the company [item (e); highest mean and low variance]. The statements presented in Table 12 may be grouped according to the following job dimensions:

(1) Changes in the Variety of Skills [(a), (i), (j) of Table 12].

On average, hourly employees affected by technological change unambiguously indicated that their skill levels have increased; notably, on average, the respondents also indicated that their jobs required a greater variety of skills--although the variance of responses is high for this statement, with several respondents indicating complete disagreement.

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[25] When one considers the Maintenance and Operations subsamples separately (see Table 11), the Maintenance respondents ranked Opportunity for More or Less Shift Work as having improved the most whereas Operations respondents ranked Amount of Physical Work as having improved the most.

[26] Rousseau (1977) essentially follows the characterization of job dimensions developed in the following study:

Hackman, J.R., Oldham, G.R., Janson, R., and Purdy, K., A New Strategy for Job Enrichment, Yale University, Department of Administrative Science, Technical Report No. 3, 1974.

(2) Ability to Identify Whole Pieces of Completed Work and Tasks that are Meaningful [(f),(k),(n),(q) of Table 12].

The hourly employees unambiguously agreed (on average) with the statement that technology resulted in increased job specialization (high mean and low variance). This result is consistent with expressed employee views that jobs affected by the introduction of new technology resulted, on average, in no change in the opportunity to complete a whole piece of work, but that jobs may be more repetitive and that workers now have the ability to exert greater quality control.

(3) Significance of the Job in Affecting Other Employees [(g),(l),(o),(r) of Table 12].

Hourly employees indicated neither agreement nor disagreement (on average) with the statements that they now worked more closely with other workers, or that the level of cooperation with co-workers is greater (although the variation in responses is high, particularly in Maintenance), as a consequence of the introduction of new technology. However they indicated, on average, that their job now affects more people and that their job is more important. Note that the high variance associated with these responses renders these results somewhat tentative.

(4) The Level of Decision-making Autonomy [(h),(m),(p) of Table 12].

The results relating to whether various aspects of decision-making autonomy have been changed are consistent with the two conclusions that the hourly employees agree (on average) that the impact of technological innovation on their job tasks has been both to increase their level of independence with regard to how work is done and to increase their opportunities for independent decision-making.

(5) Performance Feedback [(s) of Table 12].

Employees indicated that (on average) the effect of technological change has been to create a job environment that provides more feedback. However, the high variance for this response (particularly in the Maintenance subsample), and the fact that only one statement was used to capture this job dimension suggests that employees vary widely in their experiences.

(6) Work Environment [(b), (c), (d) of Table 12].

Finally, respondents were asked to assess several statements relating to the physical environment of the job-type. Employees indicated (on average) that the level of physical effort has been reduced, but that the general environment and safety conditions appear to be unchanged.[27] It would be instructive to repeat the survey of employee perceptions after employees have become familiar with the equipment. At the time of the survey the introduction of technological changes had only begun to take place so that employees may, therefore, not yet be fully experienced with the new equipment.

Approximately 79% of all the foremen respondents indicated that some new technology had been introduced into their areas in 1986 or 1987. Interestingly, among those foremen 83% (90%) of the Operations (Maintenance) supervisors discussed the new technology with 50% or less of the employees directly affected by the new technology before the final design specifications were decided (see Table 13). Among the foremen, 75% (90%) of the Operations (Maintenance) supervisors did not discuss (with employees affected by new technology) the impact of the new technology on the restructuring of jobs or duties before the final design specifications were decided; of the 20% (33%) of the responding supervisors in Operations (Maintenance) who did discuss the effects of the new technology with at least some of the workers affected in their work area, discussions were held with a wide range in the proportion of the affected workers--specifically, from 10% to 100% (20% to 60%) of the affected workers that they supervise. Only one foreman in Operations discussed the effects of technological change with 100% of the affected workers that they supervise. Finally, among the foremen who responded, 75% (80%) of the supervisors in Operations (Maintenance) did not discuss the impact of the new technology on jobs or employment levels with any of those employees directly affected by the new technology after the new technology had been selected or introduced. Approximately 17% (20%) of the supervisors in Operations (Maintenance) did discuss the effects of the new technology with 100% of the workers who were directly affected after the new technology had been selected or introduced.[28]

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[27] For the More Physical Effort job dimension, relative to Operations, the mean response was higher and the variance lower in the Maintenance subsample.

These results suggest that supervisors tend to either "discuss" the impacts or "not discuss" the impacts of the introduction of new technologies with the employees that they supervise (refer to Table 13). Overall, the results support the conclusion that the predominant proportion of supervisors do not discuss the various impacts of new technologies with the workers that they supervise and that if supervisors do discuss the impacts, they typically do so with a small proportion of their workforce.

Finally, the suppliers of new equipment provided training in the form of written manuals in areas supervised by 88% of all foremen and provided on-the-job training in areas supervised by 58% of the foremen. In only 21% of the areas supervised by foremen did the suppliers return to the refinery periodically to train workers.

## 5 Concluding Remarks

Several firm and union organizational level and general public policy issues arise as a consequence of the firm-level transformation of the production processes and the resultant changes in the internal labour market of the refinery. The public policy issues arise because of the consequences of plant modernization for employment levels and employee (re)training.

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[28] This occurred for 2 foremen in Operations and 2 foremen in Maintenance.

The first problem confronting the firm is the issue of how to carry out the downsizing of the labour force. Two firm-side options include layoffs and/or incentive packages for early retirement. However, to the extent that high seniority is positively correlated with firm-specific training and therefore high productivity, early retirement incentive programs may result in the loss of valued employees. Conversely, both the firm and low-tenured workers are most likely to benefit in the long run from human-capital investment in low seniority employees since the time remaining in which to capture returns to the investment is longest among those employees; however, under last-in-first-out seniority rules the firm may be constrained to lay off the lowest-seniority employees (who are typically also the youngest employees) first. The presence of strong seniority rules concerning layoffs would also frustrate firm attempts to selectively lay off those employees who are perceived to be of either low productivity or untrainable in the post-technological change environment. Consequently, these conflicting considerations suggest that in the short run there may be no firm-side downsizing policy that yields unambiguously positive benefits to either the firm or employees.

Second, in the event that certain employees are deemed to be either untrainable on the new production technology or redundant, there exist potentially constructive roles for both the firm and government to relieve the burden of displacement from the individual employee. Assuming that employee transfers within the firm are unfeasible and that a certain amount of displacement is inevitable, the firm could offer early retirement packages to older workers, offer displacement benefits to younger workers, and subsidize retraining programs (such as trades school or community college). Government initiatives may similarly respond by subsidizing training programs to ease adjustments. Firm involvement in such programs is also likely to be a union bargaining goal.

Third, it is important to note that many of the production technologies introduced into the refinery are essentially unique to that refinery. Consequently, employee (re)training programs are best undertaken at that refinery through on-the-job apprenticeship programs. This precludes a role for training in community colleges or formal trades programs external to the firm. This is one of the important results of this analysis: as the introduction of new production technologies accelerates and as the job content of positions within such firms becomes increasingly unique, the role of general training that is transferable among firms is supplanted in favour of an increased reliance on on-the-job training programs. In order to encourage investment in training, a public policy which encourages firms and their employees to engage in (re)training at the plant level is required. This point is reinforced by the observation that production technologies change rapidly and are becoming increasingly unique to specific plants.

The results of the in-plant surveys of employee experiences suggests that numerous challenges to both the firm and union in responding to the new organizational requirements imposed by the modernization program. Importantly, the initiatives of individual employees, the union, and the firm generally require the simultaneous and/or joint response of the various parties.

In which ways should management and union policies proceed from the current state of human resource and industrial relations practices?[29] Given the highly structured job hierarchy of the refinery's internal labour market, it is interesting that the results suggest that multi-skilling would likely reduce inefficiencies associated with current lines of demarcation among jobs. Since the completion of the modernization program should result in substantial further transformations of the refinery's internal labour market, a further implication of the introduction of new technologies is expected to be a need to upskill and multi-skill the remaining employees in the refinery, since line workers have to actually engage in the operation of the new equipment.[30] Furthermore, the need to re-skill the hourly-rated workforce suggests that a high level of up-front training expenditures is required, both coincident with and directly following the time period during which the new technologies are introduced, with human capital investments in subsequent time periods directed toward offsetting the potentially costly effects of human capital depreciation. However, the effects of the modernization program also imply the less obvious result that the supervisory workforce should also undergo intensive human capital investment expenditures. Since we also expect that remaining labour will be of higher average quality (higher skill levels), the marginal costs of not maintaining skill levels at the new (higher) optimal level and/or the use of inappropriate work group organization will increase. Specifically, we expect that the relative importance of each of the following factors will be significantly greater in the post-modernization environment: (i) multi-skilling of the hourly-rated workforce (as distinguished from up-skilling); (ii) team work among hourly-rated workers; (iii) information-sharing between line supervisors and hourly-rated workers; and (iv) the role of the line-supervisor as a team leader.

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[29] This question is particularly crucial given the following two expected developments: first, a continued rapid pace of technological advances and associated implications for changing both the skill mix of the workforce and supervisor-employee relations at the level of the workplace; and second, sustained and likely intensified international product competition into the medium and long terms.

In the long-run we expect the optimal (profit-maximizing) capital-labour ratio to be significantly higher after the infusion of new technologies than the capital-labour ratio under the old production process and work methods. Using a production process with a higher capital-labour ratio (and if the requisite skill requirements of the workforce increases) we expect the strategic importance of individual skilled workers in the production process to increase, all else equal.[31] Second, as employee skills and knowledge become more unique to the particular machinery used in the refinery the heterogeneity of the labour force (skill mix) may be expected to increase, with the concomitant result that substitution possibilities between grades of labour may be reduced, so that labour is expected to become more integral to the production process. The above considerations suggest that it is likely that the optimal work arrangement among employees will also be dramatically different in the medium term. Consequently another related result is that the maintenance of traditional supervisor-employee relationships is likely to be sub-optimal.

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[30] The presumption that the modernization program will result only in upskilling is a maintained assumption.

Experiences at the refinery offer a unique and important opportunity with regard to future programs of modernization/retrofitting of manufacturing facilities. As noted, relative to pre-transformation skill levels, the labour force will likely be of: (i) smaller size; (ii) greater skill levels (on average); and (iii) greater skill heterogeneity. The major conclusion is that current human resource practices and the roles of employees vis a vis their co-workers and their first-line supervisors must be fundamentally redefined if the firm and employees both are to properly manage and secure the full benefits that technological advancements offer.[32]

For the union, the prospect of the transformation of production processes and international competition in the industry also presents several important implications. First, the transformed workplace will offer employees several potential benefits, including: (i) the prospect of increased wages and benefits (commensurate with job-types of higher skill/responsibility requirements and higher productivity); and (ii) improved working conditions (physical environment and safety). Aside from changing union bargaining goals (which reflect underlying shifts in the preferences of the workforce brought about by changes in the workplace), the union faces several new challenges with regard to participation in the transformation process. The results of this analysis suggest that the following union initiatives may be appropriate: (i) seeking to participate in the process of integrating new human resource initiatives into current practices; and (ii) active involvement in the process of job restructuring and participation in programs of broadening the planning and decision-making roles of hourly-rated employees at the workplace.

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[31] Viewed alternatively, if the average skill level of the workforce increases, the marginal worker in a given work group becomes more important to the successful completion of a given job task or in the maintenance of normal equipment operations.

[32] See Katz, Kochan and Keefe (1987) and Cutcher-Gershenfeld (1988) for important recent findings of the effect of plant-level industrial relations practices on the economic performance of the firm.

It is appropriate to note several related points. First, there are costs to both the union and firm of not engaging in innovative human resource and industrial relations practices. For the firm, failure to engage in a sustained higher level of commitment to human resources programs will result in lower productivity production units than are potentially achievable in new plants, possible skills shortages and associated cost increases (e.g., overtime or production downtime) and a labour force that is not productively competitive with comparable firms. To the extent that the ability of the union to secure improved benefits and working conditions for the membership is contingent on firm profitability, efficiency and productivity, then union failure to encourage new practices that improve firm performance will hinder their own ability to improve employee welfare.

Finally, the initiatives suggested above ideally require planning both prior to and following the implementation of the new technologies and production processes. New programs should be designed and implemented along with the engineering process. Otherwise, human resource policies will constantly be reactive to problems and issues as previous (and possibly no longer appropriate) human resource/industrial relations policies are transplanted into transformed workplaces that require new approaches.

At the organization studied, our analysis has suggested that both the firm and the union have in fact adopted reactive roles in the adaptation process, thereby maintaining, in large part, historic human resource and industrial relations practices. Specifically, while training programs for the hourly-rated workforce have traditionally been utilized, there appears to have been no attempt to devote increased resources to develop training programs to address the specific long-run requirements of the post-technological change workforce. In particular, there have been no formal attempts to develop team or group organizations that could, for example, integrate hourly-rated and staff functions. Yet the survey results from the refinery suggest that team or group work is also a preferred arrangement for hourly employees. This form of organization would also have the effect of facilitating greater levels of information exchange and decision-sharing among vertically related levels of decision-making in the facility. Ongoing human resource programs have not been developed specifically for staff employees; for example, staff could be up-skilled in both communication and decision-sharing skills.

However, the firm has substantially redefined the job structure to increase the efficiency of operations generally, but particularly to meet the requirements of the new production processes. A substantial proportion of the pre-transformation job-types have been either made redundent, combined or eliminated. This process has occurred with substantial union involvement, through a formal job evaluation committee that is responsible for the assignment of wages to jobs. However, the actual job restructuring has been determined by management and has occurred in a step-wise manner that also appears to be reactive to the requirements of the new equipment as it is installed and brought into operation.

Taken together, the results imply that the firm has not pursued a policy of substantial ongoing commitment of resources either to employee development programs, (including training and upskilling) or to the re-organization of hourly-rated and supervisor work practices. The maintenance of historic human resource and industrial relations practices is only expected to perpetuate past trends in productivity and profit margins, which are tied to old production technologies and capital-labour ratios.[33]

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[33] At issue is not plant profitability per se--rather, the issue is whether efficiency is maximized.

Table 1
Requirements for Capable Job Performance[a]

| | | Employee Response Frequency | | | | | | | Std |
|---|---|---|---|---|---|---|---|---|---|
| Requirement | | 1 | 2 | 3 | 4 | 5 | Total | Mean | Dev |
| General Schooling[b] | T[c] | 5 | 4 | 19 | 14 | 8 | 50 | 3.32 | 1.15 |
| | M[c] | 0 | 0 | 8 | 9 | 3 | 20 | 3.75 | .72 |
| | O[c] | 5 | 4 | 11 | 5 | 5 | 30 | 3.03 | 1.30 |
| Trade Certificate or Diploma[d] | T | 16 | 6 | 11 | 9 | 9 | 51 | 2.78 | 1.50 |
| | M | 0 | 3 | 7 | 8 | 5 | 23 | 3.65 | .98 |
| | O | 16 | 3 | 4 | 1 | 4 | 28 | 2.07 | 1.49 |
| Apprenticeship Training[e] | T | 14 | 7 | 6 | 8 | 12 | 47 | 2.94 | 1.61 |
| | M | 0 | 1 | 3 | 7 | 10 | 21 | 4.24 | .89 |
| | O | 14 | 6 | 3 | 1 | 2 | 26 | 1.88 | 1.24 |
| On-the-Job Training[f] | T | 1 | 1 | 6 | 17 | 30 | 55 | 4.35 | 0.89 |
| | M | 0 | 0 | 2 | 10 | 11 | 23 | 4.39 | .66 |
| | O | 1 | 1 | 4 | 7 | 19 | 32 | 4.31 | 1.03 |
| Company Training[g] | T | 0 | 4 | 12 | 17 | 21 | 54 | 4.01 | 0.96 |
| | M | 0 | 2 | 4 | 11 | 5 | 22 | 3.86 | .89 |
| | O | 0 | 2 | 8 | 6 | 16 | 32 | 4.13 | 1.01 |
| Other: 3 | | | | | | | | | |

Notes:

[a] - A rank of one indicates nonimportance while a rank of 5 indicates extreme importance.
[b] - NR = 6
[c] - T = Total; M = Maintenance; O = Operations.
[d] - NR = 5
[e] - NR = 9
[f] - NR = 1
[g] - NR = 2

## Table 2

## Observed and Preferred Work Arrangements[a]

Panel A

| Category | | Employee Response Frequency | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| 1. Desire for training on other jobs[a] | T[b] | 42 | 12 | 54 |
| | M[b] | 12 | 10 | 22 |
| | O[b] | 30 | 2 | 32 |
| 2. Desire for job rotation[c] | T | 21 | 33 | 54 |
| | M | 11 | 12 | 23 |
| | O | 10 | 21 | 31 |
| 3. Does respondent ever work in teams[d] | T | 52 | 3 | 55 |
| | M | 23 | 0 | 23 |
| | O | 29 | 3 | 32 |

Panel B

| Category | | Employee Response Frequency<br>Nature of Work | | | |
|---|---|---|---|---|---|
| | | Alone | With one worker | Two or more workers | Total |
| 1. Group work In Practice[e] | T | 14 | 24 | 17 | 55 |
| | M | 4 | 16 | 3 | 23 |
| | O | 10 | 8 | 14 | 32 |
| 2. Desire for Group Work | T | 9 | 28 | 19 | 55 |
| | M | 5 | 13 | 5 | 23 |
| | O | 4 | 15 | 14 | 32 |

Notes:

[a] - NR = 2
[b] - T = Total; M = Maintenance; O = Operations.
[c] - NR = 2
[d] - NR = 1
[e] - NR = 1

Table 3

Employee Relationship with the Foreman[a]

| Statement |  | Employee Response Frequency 1 | 2 | 3 | 4 | 5 | Total | Mean | Std. Dev. |
|---|---|---|---|---|---|---|---|---|---|
| Learned new skills from co-workers[b] | T[c] | 6 | 3 | 13 | 16 | 15 | 53 | 3.58 | 1.28 |
|  | M[c] | 2 | 1 | 7 | 7 | 5 | 22 | 3.55 | 1.18 |
|  | O[c] | 4 | 2 | 5 | 9 | 10 | 31 | 3.61 | 1.36 |
| View co-workers as team | T | 0 | 6 | 9 | 10 | 31 | 56 | 4.17 | 1.06 |
|  | M | 0 | 3 | 4 | 5 | 11 | 23 | 4.04 | 1.11 |
|  | O | 0 | 3 | 5 | 5 | 20 | 33 | 4.27 | 1.04 |
| I discuss performance of work with co-workers | T | 1 | 4 | 4 | 15 | 32 | 56 | 4.30 | 1.01 |
|  | M | 0 | 1 | 1 | 8 | 13 | 23 | 4.43 | .79 |
|  | O | 1 | 3 | 3 | 7 | 19 | 33 | 4.21 | 1.14 |
| My job requires high physical effort | T | 5 | 10 | 14 | 15 | 12 | 56 | 3.34 | 1.25 |
|  | M | 1 | 4 | 9 | 7 | 2 | 23 | 3.22 | 1.00 |
|  | O | 4 | 6 | 5 | 8 | 10 | 33 | 3.42 | 1.41 |
| Foreman provides adequate instructions | T | 5 | 7 | 12 | 17 | 14 | 56 | 3.46 | 1.29 |
|  | M | 3 | 2 | 8 | 6 | 4 | 23 | 3.26 | 1.25 |
|  | O | 2 | 5 | 4 | 11 | 10 | 33 | 3.61 | 1.32 |
| Foreman does not provide adequate information[d] | T | 19 | 10 | 17 | 4 | 5 | 55 | 2.38 | 1.28 |
|  | M | 4 | 6 | 11 | 1 | 1 | 23 | 2.52 | .99 |
|  | O | 15 | 4 | 6 | 3 | 4 | 32 | 2.28 | 1.46 |
| Foreman aware production problems | T | 2 | 6 | 7 | 21 | 20 | 56 | 3.91 | 1.12 |
|  | M | 2 | 4 | 3 | 10 | 4 | 23 | 3.43 | 1.24 |
|  | O | 0 | 2 | 4 | 11 | 16 | 33 | 4.24 | .90 |
| Foreman aware health & safety | T | 2 | 7 | 10 | 13 | 24 | 56 | 3.89 | 1.20 |
|  | M | 1 | 5 | 3 | 4 | 10 | 23 | 3.74 | 1.36 |
|  | O | 1 | 2 | 7 | 9 | 14 | 33 | 4.00 | 1.09 |

Table 3 (continued)

| Statement | | 1 | 2 | 3 | 4 | 5 | Total | Mean | Std. Dev. |
|---|---|---|---|---|---|---|---|---|---|
| | | Employee Response Frequency | | | | | | | |
| Foreman creates[d] good work environment | T | 8 | 7 | 10 | 19 | 11 | 55 | 3.27 | 1.40 |
| | M | 3 | 4 | 5 | 9 | 2 | 23 | 3.13 | 1.22 |
| | O | 5 | 3 | 5 | 10 | 9 | 33 | 3.36 | 1.52 |

Notes:

[a] - A rank of 1 indicates disagreement while a rank of 5 indicates strong agreement.
[b] - NR = 3
[c] - T = Total; M = Maintenance; O = Operations.
[d] - NR = 1

# Table 4

## Importance of Obtaining Improvements in Current Job-Type Work Conditions[a]

| | | Employee Response Frequency | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Condition | | 1 | 2 | 3 | 4 | 5 | Total | Mean | Std Dev |
| More wages[b] | T[c] | 0 | 2 | 14 | 12 | 26 | 54 | 4.15 | 0.94 |
| | M[c] | 0 | 0 | 8 | 5 | 8 | 23 | 4.00 | .89 |
| | O[c] | 0 | 2 | 6 | 7 | 18 | 33 | 4.24 | .97 |
| Better safety[b] | T | 0 | 2 | 11 | 13 | 28 | 54 | 4.24 | 0.91 |
| | M | 0 | 1 | 3 | 8 | 11 | 23 | 4.26 | .86 |
| | O | 0 | 1 | 8 | 5 | 17 | 31 | 4.23 | .96 |
| More opportunity for overtime | T | 11 | 14 | 18 | 3 | 10 | 56 | 2.78 | 1.34 |
| | M | 2 | 5 | 13 | 2 | 1 | 23 | 2.78 | .90 |
| | O | 9 | 9 | 5 | 1 | 9 | 33 | 2.76 | 1.58 |
| Opportunity for more or less shiftwork[b] | T | 24 | 8 | 5 | 7 | 10 | 54 | 2.46 | 1.60 |
| | M | 13 | 3 | 1 | 3 | 1 | 21 | 1.86 | 1.31 |
| | O | 11 | 5 | 4 | 4 | 9 | 33 | 2.85 | 1.66 |
| Better environment | T | 3 | 2 | 5 | 11 | 35 | 56 | 4.30 | 1.13 |
| | M | 0 | 1 | 2 | 3 | 17 | 23 | 4.57 | .84 |
| | O | 3 | 1 | 3 | 8 | 18 | 33 | 4.12 | 1.27 |
| Less physical work | T | 5 | 13 | 14 | 8 | 16 | 56 | 3.30 | 1.35 |
| | M | 3 | 6 | 8 | 5 | 1 | 23 | 2.78 | 1.09 |
| | O | 2 | 7 | 6 | 3 | 15 | 33 | 3.67 | 1.41 |
| Other: 6 | | | | | | | | | |

Notes:

[a] - A rank of 1 indicates nonimportance while a rank of 5 indicates extreme importance.

[b] - NR = 2

[c] - T = Total, M = Maintenance; O = Operations.

## Table 5
## Importance of Work Conditions When Choosing Jobs

| | | Employee Response Frequency | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | Total | Mean |
| More wages[b] | T[c] | 2 | 3 | 18 | 12 | 19 | 54 | 3.80 |
| | M[c] | 1 | 2 | 11 | 6 | 2 | 22 | 3.27 |
| | O[c] | 1 | 1 | 7 | 6 | 17 | 32 | 4.16 |
| Better safety[d] | T | 1 | 4 | 7 | 11 | 32 | 55 | 4.25 |
| | M | 0 | 1 | 3 | 4 | 14 | 22 | 4.41 |
| | O | 1 | 3 | 4 | 7 | 18 | 33 | 4.15 |
| More opportunity for overtime[d] | T | 16 | 13 | 15 | 2 | 9 | 55 | 2.55 |
| | M | 5 | 7 | 8 | 1 | 1 | 22 | 2.36 |
| | O | 11 | 6 | 7 | 1 | 8 | 33 | 2.67 |
| Opportunity for more or less shiftwork[e] | T | 19 | 7 | 9 | 4 | 13 | 52 | 2.71 |
| | M | 11 | 1 | 2 | 3 | 5 | 22 | 2.55 |
| | O | 8 | 6 | 7 | 1 | 8 | 30 | 2.83 |
| Better environment[b] | T | 2 | 2 | 12 | 7 | 31 | 54 | 4.17 |
| | M | 0 | 1 | 4 | 3 | 13 | 21 | 4.33 |
| | O | 2 | 1 | 8 | 4 | 18 | 33 | 4.06 |
| Less physical work[d] | T | 6 | 13 | 15 | 5 | 15 | 54 | 3.19 |
| | M | 4 | 6 | 8 | 2 | 1 | 21 | 2.52 |
| | O | 2 | 7 | 7 | 3 | 14 | 33 | 3.61 |
| Other: 3 | | | | | | | | |

Notes:

[a] - A rank of 1 indicates non-importance while a rank of 5 indicates extreme importance.

[b] - NR = 2

[c] - T = Total; M = Maintenance; O = Operations.

[d] - NR = 1

[e] - NR = 4

## Table 6

## Perceived Importance of Alternative Job-Change Criteria

Panel A — Worker Rating of Job-change Criteria[a]

| Factor | | Employee Response Frequency 1 | 2 | 3 | 4 | 5 | Total | Mean | Std Dev |
|---|---|---|---|---|---|---|---|---|---|
| Seniority[b] | T[c] | 3 | 8 | 15 | 8 | 21 | 55 | 3.65 | 1.28 |
| | M[c] | 2 | 3 | 9 | 4 | 5 | 23 | 3.30 | 1.22 |
| | O[c] | 1 | 5 | 6 | 4 | 16 | 32 | 3.91 | 1.28 |
| Training[d] | T | 0 | 0 | 8 | 17 | 29 | 54 | 4.39 | .74 |
| | M | 0 | 0 | 2 | 13 | 7 | 22 | 4.23 | .62 |
| | O | 0 | 0 | 6 | 4 | 22 | 32 | 4.50 | .80 |
| Ability[b] | T | 0 | 1 | 7 | 16 | 31 | 55 | 4.40 | .78 |
| | M | 0 | 0 | 3 | 8 | 12 | 23 | 4.39 | .72 |
| | O | 0 | 1 | 4 | 8 | 19 | 32 | 4.41 | .84 |
| Other: 1 | | | | | | | | | |

Panel B — Workers Perception of Union's Rating of Relative Importance of Job-Change Criteria[a]

| Factor | | Employee Response Frequency 1 | 2 | 3 | 4 | 5 | Total | Mean | Std. Dev. |
|---|---|---|---|---|---|---|---|---|---|
| Seniority[e] | T | 1 | 3 | 6 | 13 | 30 | 53 | 4.28 | 1.01 |
| | M | 0 | 1 | 2 | 8 | 11 | 22 | 4.32 | .84 |
| | O | 1 | 2 | 4 | 5 | 19 | 31 | 4.26 | 1.12 |
| Training | T | 3 | 9 | 12 | 13 | 19 | 56 | 3.64 | 1.26 |
| | M | 1 | 5 | 5 | 8 | 4 | 23 | 3.39 | 1.16 |
| | O | 2 | 4 | 7 | 5 | 15 | 33 | 3.82 | 1.31 |
| Ability | T | 7 | 7 | 11 | 13 | 18 | 56 | 3.50 | 1.39 |
| | M | 3 | 4 | 6 | 6 | 4 | 23 | 3.17 | 1.30 |
| | O | 4 | 3 | 5 | 7 | 14 | 33 | 3.73 | 1.42 |
| Other: 1 | | | | | | | | | |

Table 6 (continued)

Panel C Workers Perception of Company's Rating of Relative Importance of Job-Change Criteria[a]

| Factor | | Employee Response Frequency | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | Total | Mean | Std. Dev. |
| Seniority[f] | T | 4 | 12 | 18 | 6 | 13 | 53 | 3.23 | 1.27 |
| | M | 3 | 4 | 7 | 4 | 4 | 22 | 3.09 | 1.31 |
| | O | 1 | 8 | 11 | 2 | 9 | 31 | 3.32 | 1.25 |
| Training | T | 1 | 5 | 12 | 19 | 19 | 56 | 3.89 | 1.04 |
| | M | 0 | 2 | 5 | 14 | 2 | 23 | 3.70 | .76 |
| | O | 1 | 3 | 7 | 5 | 17 | 33 | 4.03 | 1.19 |
| Ability | T | 4 | 6 | 3 | 17 | 21 | 56 | 3.80 | 1.26 |
| | M | 1 | 2 | 3 | 12 | 5 | 23 | 3.78 | 1.04 |
| | O | 3 | 4 | 0 | 5 | 16 | 33 | 3.82 | 1.40 |

Other: 1

Notes:

[a] - A rank of 1 indicates nonimportance while a rank of 5 indicates extreme importance.
[b] - NR = 1
[c] - T = Total; M = Maintenance; O = Operations.
[d] - NR = 2
[e] - NR = 3
[f] - NR = 3

Table 7

Promotion Criteria Used By Supervisors

| | Promotion to Longest Seniority Applicant[a] | | | | Promotion to Highest Ability Person[b] | | | |
|---|---|---|---|---|---|---|---|---|
| | Frequency | | | Percent | Frequency | | | Percent |
| Percentage of Time | M[c] | O[c] | T[c] | T | M | O | T | T |
| 0 | 0 | 0 | 0 | 0 | 5 | 12 | 17 | 63.0 |
| 10 | 0 | 0 | 0 | 0 | 3 | 2 | 5 | 18.5 |
| 20 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 7.4 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50 | 1 | 0 | 1 | 3.7 | 0 | 0 | 0 | 0 |
| 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 3.7 |
| 80 | 1 | 0 | 1 | 3.7 | 0 | 0 | 0 | 0 |
| 90 | 2 | 1 | 3 | 11.1 | 0 | 0 | 0 | 0 |
| 100 | 8 | 14 | 22 | 81.5 | 1 | 1 | 2 | 7.4 |
| Total | 12 | 15 | 27 | 100.0 | 12 | 15 | 27 | 100.0 |

Notes:

[a] Survey Question:When several hourly employees bid for a promotion and each employee is at least minimally qualified for the new job, what percentage of the time does the promotion go to the longest seniority applicant?

[b] Survey Question When several hourly employees bid for a promotion and each employee is at least minimally qualified for the new job, what percentage of the time does the promotion go to an individual with abilities head and shoulders above the longest seniority applicant?

[c] M = Maintenance; O = Operations; T = Total.

## Table 8
## Types of Foreman Certification That Employees Have Completed Training

Panel A

| Employee Written Test | Foreman Frequency M[a] | O[a] | T[a] | Percent |
|---|---|---|---|---|
| Yes | 4 | 15 | 19 | 73.1 |
| No | 7 | 0 | 7 | 26.9 |
| Total[b] | 11 | 15 | 26 | 100.0 |

Panel B

| Foreman Written Assignment | Foreman Frequency M | O | T | Percent |
|---|---|---|---|---|
| Yes | 8 | 14 | 22 | 84.6 |
| No | 3 | 1 | 4 | 15.4 |
| Total[c] | 11 | 15 | 26 | 100.0 |

Panel C

| Foreman Observed Assessment | Foreman Frequency M | O | T | Percent |
|---|---|---|---|---|
| Yes | 12 | 15 | 27 | 100.0 |
| No | 0 | 0 | 0 | 0 |
| Total[d] | 12 | 15 | 27 | 100.0 |

Notes:
[a] - M = Maintenance; O = Operations; T = Total.
[b] - NR = 2
[c] - NR = 2
[d] - NR = 1

## Table 9
## Foreman - Worker Relationship

| | | Employee Response By Level of Agreement[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | | 1 | 2 | 3 | 4 | 5 | Total | Mean | Std Dev. |
| a) Trust between[b] | T[c] | 2 | 6 | 0 | 13 | 8 | 29 | 3.66 | 1.29 |
| | M[c] | 1 | 4 | 0 | 7 | 4 | 16 | 3.56 | 1.31 |
| | O[c] | 1 | 2 | 0 | 5 | 4 | 13 | 3.77 | 1.30 |
| b) Agree on how to perform work[b] | T | 0 | 2 | 5 | 13 | 9 | 29 | 4.00 | .89 |
| | M | 0 | 2 | 4 | 5 | 5 | 16 | 3.81 | 1.05 |
| | O | 0 | 0 | 1 | 8 | 4 | 13 | 4.23 | .60 |
| c) Agree on job safety[d] | T | 0 | 2 | 3 | 11 | 14 | 30 | 4.23 | .90 |
| | M | 0 | 1 | 2 | 7 | 7 | 17 | 4.18 | .88 |
| | O | 0 | 1 | 1 | 4 | 7 | 13 | 4.30 | .95 |
| d) Worker is consulted in planning job tasks[d] | T | 4 | 3 | 8 | 10 | 5 | 30 | 3.30 | 1.26 |
| | M | 4 | 2 | 2 | 6 | 3 | 17 | 3.12 | 1.50 |
| | O | 0 | 1 | 6 | 4 | 2 | 13 | 3.54 | .88 |
| e) Worker treated courteously[d] | T | 1 | 2 | 6 | 10 | 11 | 30 | 3.93 | 1.08 |
| | M | 0 | 2 | 2 | 5 | 8 | 17 | 4.12 | 1.05 |
| | O | 1 | 0 | 4 | 5 | 3 | 13 | 3.69 | 1.11 |
| f) Worker is not treated fairly[d] | T | 11 | 5 | 7 | 6 | 1 | 30 | 2.37 | 1.27 |
| | M | 6 | 4 | 1 | 5 | 1 | 17 | 2.47 | 1.42 |
| | O | 5 | 1 | 6 | 1 | 0 | 13 | 2.23 | 1.09 |
| g) Workers ideas about work not sought[d] | T | 6 | 6 | 7 | 9 | 2 | 30 | 2.83 | 1.26 |
| | M | 4 | 4 | 2 | 6 | 1 | 17 | 2.76 | 1.35 |
| | O | 2 | 2 | 5 | 3 | 1 | 13 | 2.92 | 1.19 |
| h) Foreman expresses interest in my ideas[d] | T | 4 | 1 | 7 | 10 | 8 | 30 | 3.57 | 1.31 |
| | M | 2 | 1 | 3 | 6 | 5 | 17 | 3.65 | 1.32 |
| | O | 2 | 0 | 4 | 4 | 3 | 13 | 3.46 | 1.33 |
| i) Foreman provides leadership[d] | T | 2 | 5 | 7 | 8 | 8 | 30 | 3.50 | 1.25 |
| | M | 1 | 5 | 2 | 6 | 3 | 17 | 3.29 | 1.26 |
| | O | 1 | 0 | 5 | 2 | 5 | 13 | 3.77 | 1.24 |
| j) Foreman often provides feedback[d] | T | 5 | 4 | 6 | 10 | 5 | 30 | 3.20 | 1.35 |
| | M | 3 | 2 | 5 | 3 | 4 | 17 | 3.18 | 1.42 |
| | O | 2 | 2 | 1 | 7 | 1 | 13 | 3.23 | 1.30 |

Notes:

[a] - A rank of 1 indicates nonagreement while a rank of 5 indicates extreme agreement.

[b] - NR = 2

[c] - T = Total; M = Maintenance; O = Operations.

[d] - NR = 1

## Table 10

## Employee Participation and Communication In Groups

|  | Discuss Production/Quality[a] |  |  |  | Given Performance Information[b] |  |  |  | Discuss Attitudes[c] |  |  |  | Problem Solving[d] |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Foreman Frequency |  |  |  | Foreman Frequency |  |  |  | Foreman Frequency |  |  |  | Foreman Frequency |  |  |  |
| % of Empl. | M[e] | O[e] | T[e] | % | M | O | T | % | M | O | T | % | M | O | T | % |
| 0 | 8 | 4 | 12 | 42.9 | 8 | 4 | 12 | 46.2 | 6 | 5 | 11 | 39.3 | 9 | 12 | 21 | 5.0 |
| 10 | 2 | 2 | 4 | 14.3 | 0 | 1 | 1 | 3.8 | 0 | 2 | 2 | 7.1 | 1 | 1 | 2 | 7.1 |
| 20 | 1 | 0 | 1 | 3.6 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 3.6 | 1 | 0 | 1 | 3.6 |
| 30 | 0 | 2 | 2 | 7.1 | 0 | 1 | 1 | 3.8 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3.6 |
| 40 | 0 | 1 | 1 | 3.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50 | 1 | 1 | 2 | 7.1 | 0 | 2 | 2 | 7.7 | 0 | 1 | 1 | 3.6 | 0 | 1 | 1 | 3.6 |
| 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 7.7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 100 | 1 | 5 | 6 | 21.4 | 4 | 4 | 8 | 30.8 | 6 | 7 | 13 | 46.4 | 2 | 0 | 2 | 7.1 |
| T | 13 | 15 | 28 |  | 12 | 14 | 26 |  | 13 | 15 | 28 |  | 13 | 15 | 28 |  |
| 100 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Notes:

[a] Survey Question: What percentage of the hourly employees you supervise are called by you or another supervisor to meet on a regular basis in small groups to discuss production or quality problems?

[b] Survey Question: What percentage of the hourly employees you supervise regularly track or are given statistical information on their work group's quality or productivity performance?

[c] Survey Question: For what percentage of the hourly employees are their attitudes regularly assessed through surveys or are discussed regularly in group meetings organized by you or another supervisor?

[d] Survey Question: What percentage of the hourly employees you supervise regularly receive formal training in group problem-solving, decision-making, and communications from the company?

[e] M = Maintenance; O = Operations; T = Total.

## Table 11
## Conditions Changed as a Result of Technological Changes

| | | Employee Response Frequency | | | | | |
|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | | | Std. |
| | | Better | Same | Worse | Total | Mean | Dev. |
| a) Wages[a] | T[b] | 3 | 16 | 1 | 20 | 1.90 | .45 |
| | M[b] | 1 | 8 | 0 | 9 | 1.89 | .33 |
| | O[b] | 2 | 8 | 1 | 11 | 1.91 | .54 |
| b) Safety[c] | T | 5 | 14 | 0 | 19 | 1.74 | .45 |
| | M | 1 | 7 | 0 | 8 | 1.88 | .35 |
| | O | 4 | 7 | 0 | 11 | 1.64 | .50 |
| c) Opportunity for Overtime[a] | T | 4 | 14 | 2 | 20 | 1.90 | .55 |
| | M | 3 | 5 | 1 | 9 | 1.78 | .67 |
| | O | 1 | 9 | 1 | 11 | 2.00 | .45 |
| d) Opportunity for more or less Shift Work[c] | T | 2 | 15 | 2 | 19 | 2.00 | .47 |
| | M | 2 | 6 | 0 | 8 | 1.75 | .46 |
| | O | 0 | 9 | 2 | 11 | 2.18 | .40 |
| e) Environment[a] | T | 7 | 9 | 4 | 20 | 1.85 | .75 |
| | M | 2 | 6 | 1 | 9 | 1.89 | .60 |
| | O | 5 | 3 | 3 | 11 | 1.82 | .87 |
| f) Amount of Physical Work[a] | T | 8 | 11 | 1 | 20 | 1.65 | .59 |
| | M | 2 | 7 | 0 | 9 | 1.78 | .44 |
| | O | 6 | 4 | 1 | 11 | 1.55 | .69 |
| g) Other : (3) | | | | | | | |

Notes:

[a] NR = 11
[b] T = Total; M = Maintenance; O = Operations.
[c] NR = 12

## Table 12
## Employee Perceptions of the Effects of Technological Change

| Job Dimension | | Employee Response Frequency By Level of Agreement[a] 1 | 2 | 3 | 4 | 5 | Total[c] | Mean | Std. Dev. |
|---|---|---|---|---|---|---|---|---|---|
| (a) Skills level increased | T[b] | 0 | 0 | 7 | 12 | 0 | 19 | 3.63 | 0.50 |
| | M[b] | 0 | 0 | 2 | 7 | 0 | 9 | 3.78 | .44 |
| | O[b] | 0 | 0 | 5 | 5 | 0 | 10 | 3.50 | .53 |
| (b) More physical effort | T | 7 | 4 | 5 | 1 | 2 | 19 | 2.32 | 1.34 |
| | M | 3 | 2 | 4 | 0 | 0 | 9 | 2.11 | .93 |
| | O | 4 | 2 | 1 | 1 | 2 | 10 | 2.50 | 1.65 |
| (c) Safety improved | T | 4 | 1 | 10 | 1 | 3 | 19 | 2.89 | 1.29 |
| | M | 2 | 0 | 5 | 0 | 2 | 9 | 3.00 | 1.41 |
| | O | 2 | 1 | 5 | 1 | 1 | 10 | 2.80 | 1.23 |
| (d) Improved working environment | T | 2 | 5 | 5 | 4 | 3 | 19 | 3.05 | 1.27 |
| | M | 0 | 3 | 3 | 2 | 1 | 9 | 3.11 | 1.05 |
| | O | 2 | 2 | 2 | 2 | 2 | 10 | 3 00 | 1.49 |
| (e) Tech. changes necessary to company | T | 0 | 1 | 3 | 7 | 8 | 19 | 4.16 | 0.90 |
| | M | 0 | 1 | 1 | 3 | 4 | 9 | 4.11 | 1.05 |
| | O | 0 | 0 | 2 | 4 | 4 | 10 | 4.20 | .79 |
| (f) Job more specialized | T | 0 | 1 | 6 | 9 | 3 | 19 | 3.74 | 0.81 |
| | M | 0 | 0 | 4 | 3 | 2 | 9 | 3.78 | .83 |
| | O | 0 | 1 | 2 | 6 | 1 | 10 | 3.70 | .82 |
| (g) Work less closely with others | T | 4 | 1 | 8 | 3 | 3 | 19 | 3.00 | 1.33 |
| | M | 1 | 0 | 5 | 1 | 2 | 9 | 3.33 | 1.22 |
| | O | 3 | 1 | 3 | 2 | 1 | 10 | 2.70 | 1.42 |
| (h) I now make more independant decisions | T | 2 | 3 | 7 | 3 | 4 | 19 | 3.21 | 1.27 |
| | M | 1 | 2 | 4 | 1 | 1 | 9 | 2.89 | 1.17 |
| | O | 1 | 1 | 3 | 2 | 3 | 10 | 3.50 | 1.35 |
| (i) Job requires greater variety of skills | T | 2 | 1 | 4 | 6 | 6 | 19 | 3.68 | 1.29 |
| | M | 1 | 0 | 1 | 4 | 3 | 9 | 3.89 | 1.27 |
| | O | 1 | 1 | 3 | 2 | 3 | 10 | 3.50 | 1.35 |
| (j) More opportunity to increase skills | T | 2 | 2 | 5 | 8 | 2 | 19 | 3.32 | 1.16 |
| | M | 1 | 1 | 1 | 5 | 1 | 9 | 3.94 | 1.24 |
| | O | 1 | 1 | 4 | 3 | 1 | 10 | 3.20 | 1.14 |
| (k) Job involves less repetitive | T | 5 | 2 | 8 | 3 | 1 | 19 | 2.63 | 1.21 |
| | M | 1 | 2 | 5 | 0 | 1 | 9 | 2.73 | 1.09 |
| | O | 4 | 0 | 3 | 3 | 0 | 10 | 2.50 | 1.35 |

(Table 12 continued)

| | | Employee Response Frequency By Level of Agreement[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Job Description | | 1 | 2 | 3 | 4 | 5 | Total[c] | Mean | Std Dev. |
| (l) Job affects more people now | T | 2 | 1 | 8 | 5 | 3 | 19 | 3.31 | 1.16 |
| | M | 1 | 1 | 3 | 3 | 1 | 9 | 3.22 | 1.20 |
| | O | 1 | 0 | 5 | 2 | 2 | 10 | 3.40 | 1.17 |
| (m) Less opportunity for independent decisions | T | 3 | 3 | 10 | 2 | 1 | 19 | 2.74 | 1.05 |
| | M | 2 | 2 | 4 | 0 | 1 | 9 | 2.56 | 1.24 |
| | O | 1 | 1 | 6 | 2 | 0 | 10 | 2.90 | .88 |
| (n) Greater control of quality | T | 2 | 2 | 5 | 7 | 3 | 19 | 3.36 | 1.21 |
| | M | 1 | 1 | 3 | 2 | 2 | 9 | 3.33 | 1.32 |
| | O | 1 | 1 | 2 | 5 | 1 | 10 | 3.40 | 1.17 |
| (o) Job is more important | T | 3 | 1 | 6 | 7 | 2 | 19 | 3.21 | 1.23 |
| | M | 2 | 0 | 2 | 4 | 1 | 9 | 3.22 | 1.39 |
| | O | 1 | 1 | 4 | 3 | 1 | 10 | 3.20 | 1.14 |
| (p) More independence in how work is done | T | 2 | 2 | 6 | 6 | 3 | 19 | 3.31 | 1.20 |
| | M | 1 | 1 | 3 | 3 | 1 | 9 | 3.22 | 1.20 |
| | O | 1 | 1 | 3 | 3 | 2 | 10 | 3.40 | 1.26 |
| (q) Less opportunity to produce a complete piece of work | T | 1 | 5 | 8 | 2 | 2 | 18 | 2.94 | 1.06 |
| | M | 1 | 2 | 3 | 0 | 2 | 8 | 3.00 | 1.41 |
| | O | 0 | 3 | 5 | 2 | 0 | 10 | 2.90 | .74 |
| (r) More cooperation with co-workers | T | 3 | 3 | 7 | 3 | 3 | 19 | 3.00 | 1.29 |
| | M | 3 | 0 | 3 | 2 | 1 | 9 | 2.78 | 1.48 |
| | O | 0 | 3 | 4 | 1 | 2 | 10 | 3.20 | 1.14 |
| (s) Job provides more feedback | T | 1 | 3 | 8 | 4 | 3 | 19 | 3.26 | 1.10 |
| | M | 1 | 1 | 2 | 3 | 2 | 9 | 3.44 | 1.33 |
| | O | 0 | 2 | 6 | 1 | 1 | 10 | 3.10 | .88 |

Note:

[a] A rank of 1 indicates nonagreement while a rank of 5 indicates extreme agreement.

[b] T = Total; M = Maintenance; O = Operations.

[c] NR = 12

## Table 13

## Employees Directly Affected By New Technology

| | Foremen Discuss with Employees: | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) Final Design Specifications[a] | | | | (2) Restructuring Jobs or Duties[b] | | | | (3) Impact on Jobs After Interaction[c] | | | |
| | Frequency | | | | Frequency | | | | Frequency | | | |
| Percentage of Workers | M[d] | O[d] | T[d] | % | M | O | T | % | M | O | T | % |
| 0 | 9 | 2 | 11 | 50.0 | 8 | 8 | 16 | 72.7 | 8 | 6 | 14 | 63.6 |
| 1-9 | 0 | 2 | 2 | 9 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 4.5 |
| 10 | 0 | 3 | 3 | 13.6 | 0 | 1 | 1 | 4.5 | 0 | 1 | 1 | 4.5 |
| 20 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 4.5 | 0 | 1 | 1 | 4.5 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50 | 1 | 3 | 4 | 18.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 60 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 4.5 | 0 | 0 | 0 | 0 |
| 70 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 4.5 | 0 | 0 | 0 | 0 |
| 80 | 0 | 1 | 1 | 4.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 90 | 0 | 1 | 1 | 4.5 | 0 | 1 | 1 | 4.5 | 0 | 1 | 1 | 4.5 |
| 100 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 4.5 | 2 | 2 | 4 | 18.2 |
| Total | 10 | 12 | 22 | 100 | 10 | 12 | 22 | 100 | 10 | 12 | 22 | 100 |

Notes:

[a] Survey Question: Of those workers directly affected by new technology in your area new machines or processes), typically what percentage of those workers discuss the new technology with management before the final design specifications are decided?

[b] Survey Question: Of those workers directly affected by new technology in your area new machines or processes, typically what percentage of those workers discuss with management the way jobs or duties will be restructured by the new technology before the final decisions are made?

[c] Survey Question: Of those workers directly affected by new technology in your area (new machines or processes), typically what percentage of those workers discuss the impact on jobs or employment levels after new technology has been selected or introduced?

[d] M = Maintenance; O = Operations; T = Total.

## Table 14
## Refinery Personnel Power[a]

| Year | Staff | Unit | Total Personnel |
|---|---|---|---|
| 1981 | 137 | 696 | 833 |
| 1982 | 121 | 536 | 657 |
| 1983 | 111 | 566 | 677 |
| 1984 | 109 | 505 | 614 |
| 1985 | 97 | 503 | 600 |
| 1986 | 98 | 487 | 585 |
| 1987 | 97 | 482 | 579 |
| 1988 | 98 | 436 | 534 |

Notes:

[a] All figures are approximate.

# References

Abraham, K.G. and Medoff, J.L. (1983), "Length of Service and the Operation of Internal Labor Markets," Harvard Institute of Economic Research, Harvard University, Discussion Paper 965, 1983.

Becker, G. (1975), Human Capital, New York: National Bureau of Economic Research, 1975.

Chaykowski, R.P. and Slotsve, G.A. "Wage Compensation and Mobility Patterns Within Unionized Firms: The Role of Internal Labour Markets," Sloan School of Management Working Paper No. 2100-88, Massachusetts Institute of Technology, (December, 1988a).

Chaykowski, R.P. and Slotsve, G.A. "The Transformation of Internal Labor Markets: A Case Study of a Unionized Industrial Firm," (Unpublished Paper, October 1988b).

Cutcher-Gershenfeld, J., "Industrial Relations and Economic Performance," Unpublished Paper, August, 1988.

Doeringer, P.B. and Piore, M.J., Internal Labor Markets and Manpower Analysis, M.E. Sharpe, New York: 1971.

Douty, H.M., "Union Impact on Wage Structures," Proceedings of the Sixth Annual Meeting, Industrial Relations Research Association, Washington, D.C., L.R. Tripp, Editor, (1966):61-76.

Garson, G.D., Political Science Methods, Holbrook Press, Boston: 1976.

Hackman, J.R., Oldham, G.R., Janson, R., and Purdy, K., A New Strategy for Job Enrichment, Yale University, Department of Administrative Science, Technical Report No. 3, 1974.

Harvey, Edward, "Technology and the Structure of Organizations," American Sociological Review, Vol.33, No.2, (1968):247-259.

Hrebiniak, Lawrence G., "Job Technology, Supervision, and Work-Group Structure," Administrative Science Quarterly, Vol.19, No.3, (1974):395-410.

Katz, H., Kochan, T., and Keefe, L., "Industrial Relations and Productivity in the U.S. Automobile Industry." Brookings Papers on Economic Activity, 3:1987: 685-727.

Kochan, T.A., "Looking to the Year 2000: Challenges for Industrial Relations and Human Resource Management," Conference Paper for "Visions of Canada in the Year 2000", sponsored by The Economic Council of Canada, November 30-December 2, 1988 in Ottawa (October, 1988).

Kochan, T.A., Katz, H. and McKersie, R.B., The Transformation of American Industrial Relations, basic Books Inc., New York, 1986.

Likert, R., "A Technique for the Measurement of Attitudes," Archives of Psychology, Vol.21, No.140, 1932.

Livernash, E.R., "Job Clusters," excerpt from "The Internal Wage Structure," in G.W. Taylor and F.C. Pierson, eds., New Concepts in Wage Determination, McGraw-Hill, 1957: 140-160.

Presser, Stanley and Schuman, H., "The Measurement of a Middle Position in Attitude Surveys," Public Opinion Quarterly, Vol.44, No.1, (Spring 1980):70-85.

Rosenbaum, J.E., "Hierarchical and Individual Effects on Earnings," Industrial Relations, Vol.19, No.1, 1980: 1-14.

Rousseau, D.M., "Relationship of Work to Nonwork," Journal of Applied Psychology, Vol.63, No.4, (1978):513-517.

Rousseau, D.M., "Technological Differences in Job Characteristics, Employee Satisfaction, and Motivation: A Synthesis of Job Design Research and Sociotechnical Systems Theory," Organizational Behaviour and Human Performance, Vol.19, No.1, (1977):18-42.

Slichter, S.H., "Notes on the Structure of Wages," The Review of Economics and Statistics, Vol.XXXII, 1950: 80-91.

Slichter, S.H., Healy, J.J. and Livernash, E., The Impact of Collective Bargaining on Management, The Brookings Institution, Washington, D.C.: 1960.

Stewman, S. and Konda, S.L., "Careers and Organizational Labor Markets: Demographic Models of Organizational Behaviour," American Journal of Sociology, Vol.88, No.4, January, 1983: 637-385.

Williamson, O.E., Wachter, M.L., and Harris, J.E., "Understanding the Employment Relations: The Analysis of Idiosyncratic Exchange," Bell Journal of Economics, Vol. 6, No. 1, 1975: 250-278.

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